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Before the Board of Patent Appeals and Interferences

Ex Parte **Shawn Stapleton**

Application No. **10/003,725**

Filed: **October 30, 2001**

For: **HIGH EFFICIENCY POWER AMPLIFIER SYSTEMS AND METHODS**

Group: **2817**

Examiner: **Henry Choe**

BRIEF ON BEHALF OF APPELLANTS

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This brief is in furtherance of the Notice of Appeal in this case filed January 27, 2005. This brief is transmitted in triplicate. The fees required under 37 C.F.R. §1.17(f) and any required petition for extension of time for filing this brief and fees therefore are dealt with in the accompanying FEE TRANSMITTAL for FY 2005.

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I. REAL PARTY IN INTEREST

Prophesi Technologies, Inc. is the real party in interest by virtue of a License Assignment recorded at REEL/FRAME 014708/0412 on October 6, 2003.

II. RELATED APPEALS AND INTERFERENCES

There are NO related appeals or interferences.

III. STATUS OF CLAIMS

A total of eighty-three (83) claims have been presented in the prosecution of the present application. The original Application inadvertently presented two claims designated as claim 5. The second claim 5 – claim 75 have been renumbered as claims 6-76. Unless otherwise clearly noted, all claim numbers hereinafter will use the present claim numbers. Claims 66-67 and 71-75 have been cancelled. Claims 39-65, 68-70 and 76 have been withdrawn from consideration. Thus Claims 1-65, 68-70 and 76-83 are presently pending including three (3) independent claims 1, 39, and 77. Claims 1-38 and 77-83 are presently pending and under consideration.

On June 13, 2003 after a telephone conversation, the Examiner with Mr. Donald Haslett elected Claims 1-38 from a Restriction/Election with traverse to prosecute the invention and Claims 39-76 were withdrawn from further consideration as being drawn to a non-elected invention.

On September 30, 2003 the second claim 5 – 75 as originally numbered were renumbered as claims 6-76. Claims 1, 4, and 20-21 were amended. Claims 66-67 and 71-75 were cancelled. Claims 39-65, 68-70 and 76 were withdrawn from present consideration. New Claims 77-83 were added.

An RCE was filed on January 23, 2004 amending claims 1, 5 and 77.

The Examiner, in the Final Office Action dated September 28, 2004, rejected claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 under 35 U.S.C. §102(b) as being anticipated by Tripathi, et al. (U.S. Patent No. 5,974,089). Claims 16, 17, and 22-24 were rejected under 35 U.S.C. §103(a) as being unpatentable over Tripathi, et al. Claims 5, 10,

12-15, 18-20, 26, 27, 29-32, 38, 80 and 81 were objected to as being dependent upon a rejected base claim.

Presently no claims have been allowed.

The claims on appeal are Claims 1-38 and 77-83.

IV. STATUS OF AMENDMENTS

One January 14, 2003 a Restriction/Election was mailed to the Applicant. Claims 1-75 as originally numbered were subjected to the Election/ Restriction under Species I – Figures 1 and 2 or Species II – Figures 1 and 3.

On June 20, 2003 an initial Office Action was mailed to the Applicant stating that on June 13, 2003 a telephone "conversion" was conducted between the Examiner and Mr. Donald Haslett. Originally numbered claims 1-37 were elected with traverse to prosecute the invention. Originally numbered claims 38-75 were withdrawn from further consideration by the Examiner as being drawn to a non-elected invention. Originally numbered claims 5-37 were objected to because of informalities, i.e. renumbering required. In the June 30, 2003 office action the Examiner stated that claims 1-4, 6-9, 11, 21, 28 and 33-37 were rejected under 35 U.S.C. §102(e) as being anticipated by Melanson (U.S. Patent No. 6,373,334) and Claims 16, 17 and 22-24 were rejected under 35 U.S.C. §103(a) as being unpatentable over Melanson. The Examiner further states that Claims 5, 10, 12-15, 18-20, 26, 27, 29-32 and 38 were objected to as being dependent upon a rejected base claim.

In response to the June 20, 2003 Office action on September 30, 2003 an Amendment Under 37 CFR §1.111 was filed by Applicant amending the specification and drawings to correct clerical errors and amending claims 1, 4, and renumbering original second claim 5-37 and claims 38-75 to claims 6-76. Claims 66-67 and 71-75 were cancelled and claims 39-65, 68-70 and 76 were withdrawn. New Claims 77-83 were added.

On November 3, 2003 a Final Rejection was mailed to Applicant. In the final rejection, the Examiner states that claims 1-4, 6-9, 11, 16, 17, 21-25, 28, 33-37 and 77-83

were rejected under 37 U.S.C. §103(a) as being unpatentable over Melanson. Claims 5, 10, 12-15, 18-20, 26, 27, 29-32 and 38 remain objected to as being dependent upon a rejected base claim.

On January 23, 2004 a Request for Continued Examination and a Preliminary Amendment Under 37 CFR 1.115 was filed amending claims 1 and 77 to further clarify the invention and claim 5 was amended to resolve an antecedent basis issue.

On March 3, 2004 an initial Office Action after RCE was mailed to the Applicant. Claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 were rejected under 35 U.S.C. §102(b) as being anticipated by Tripathi, et al. (U.S. Patent No. 5,974,089). Claims 16, 17 and 22-24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tripathi, et al. '089 Claims 5, 10, 12-15, 18-20, 26, 27, 29-32, 38, 80 and 81 were objected to as being dependent upon a rejected base claim.

On July 22, 2004 a Response Under 37 CFR 1.111 was filed seeking to traverse the Examiner's rejetions. No claims were amended.

On September 28, 2004 a Final Rejection was mailed to the Applicant. In the final rejection, claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 were still rejected under 35 U.S.C. §102(b) as being anticipated by Tripathi, et al. '089 for reasons of record. Claims 16, 17 and 22-24 were still rejected under 35 U.S.C. § 103(a) as being unpatentable over Tripathi, et al. '089 for reasons of record. Claims 5, 10, 12-15, 18-20, 26, 27, 29-32, 38, 80 and 81 were still objected to as being dependent upon a rejected base claim.

On January 27, 2005 a Notice of Appeal was filed.

V. SUMMARY OF THE INVENTION

The present invention concerns radio frequency amplifiers including a delta sigma modulator and a switching mode power amplifier in addition to an adaptive linearizer all inter-coupled in a feed back loop. The invention in one aspect (claim 1) is defined as a radio frequency amplifier system including a delta sigma modulator connected to receive an input signal and produce a bi-level modulation signal; a switching mode power amplifier driven by the bi-level modulation signal and operable to provide a radio frequency signal at an output; and a linearizer, coupled to the input signal and the radio frequency signal, operable to supply a corrective signal at a location prior to the switching mode power amplifier, the linearizer using an adaptive process.

In another aspect (claim 77) the invention is defined as a radio frequency amplifier system comprising: a bandpass delta sigma modulator connected to receive an input signal and produce a bi-level modulation signal; a switching mode power amplifier driven by the bi-level modulation signal and having an output; and a linearizer, coupled to the input signal and the output of the switching mode power amplifier, operable to supply a corrective signal at a location prior to the switching mode power amplifier, the linearizer using an adaptive linearization process.

VI. ISSUES

Issue I.

Whether Claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 are patentable under 35 U.S.C. §102(b) over Tripathi, et al. (U.S. Patent No. 5,974,089)?

VII. GROUPING OF THE CLAIMS

Claims 1 and 77 are independent in form and are considered separately patentable.

Dependent Claim 2 depends from independent claim 1. The patentability of claim 2 stands or falls with that of independent claim 1.

Dependent claim 3 depends from dependent claim 2 and thus independent Claim 1. Dependent claim 3 is considered separately patentable.

Dependent claim 4 is dependent on independent claim 1. Dependent claims 4 is considered separately patentable.

Dependent claims 6-7 depend from independent claim 1. The patentability of claims 6-7 stands or falls with that of independent claim 1.

Dependent claims 8-9 are dependent on independent claim 1. Claims 8-9 are each considered separately patentable.

Dependent claim 11 is dependent on dependent claim 10 and thus independent claim 1. Claim 10 stands objected to and is thus separately patentable. The patentability of claims 11 stands or falls with that of dependent Claim 10.

Dependent claims 16 and 17 are dependent on dependent claim 9 and thus independent claim 1. The patentability of Claims 16 and 17 stands or falls with that of dependent Claim 9.

Dependent claim 21 depends from independent claim 1. Dependent claim 21 is considered separately patentable.

Dependent claims 22-24 and 25 are dependent on independent claim 1. The patentability of Claims 22-24 and 25 stands or falls with that of Independent Claim 1.

Dependent claims 28 is dependent on independent claim 1. Claim 28 is considered separately patentable.

Dependent claims 33 and 34 are dependent on independent claim 1. Claims 33 and 34 are each considered separately patentable.

Dependent claim 35 depends from dependent claim 8 and thus independent claim 1. The patentability of claim 35 stands or falls with that of dependent claim 8.

Dependent claims 36-37 are dependent on independent claim 1. Claims 36-37 are each considered separately patentable.

Dependent claims 5, 10, 12-15, 18-20, 26-27, 29-32, and 38 are dependent on claim 1. These claims stand objected to but are believed by the Examiner to be separately patentable if rewritten to include all limitations.

Dependent Claims 78-79 depend from independent Claim 77. Dependent claims 78-79 are each considered separately patentable.

Dependent claims 82 and 83 depend from independent claim 77. Claims 82 and 83 are each considered separately patentable.

Dependent claims 80 and 81 are dependent on claim 77. These claims stand objected to but are believed by the Examiner to be separately allowable if rewritten to include all limitations.

VIII. ARGUMENT

General Background

The Examiner, in an Office Action dated March 3, 2004, rejected claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 under 35 U.S.C. §102(b) as being anticipated by Tripathi, et al. (U.S. Patent No. 5,974,089) and rejected claims 16, 17 and 22-24 under 35 U.S.C. § 103(a) as being unpatentable over Tripathi, et al. Claims 5, 10, 12-15, 18-20, 26, 27, 29-32, 38, 80 and 81 were objected to as being dependent upon a rejected base claim. The Applicant on July 22, 2004 filed a Response seeking to traverse the Examiner's rejections.

The Examiner found the arguments of July 22, 2004 not persuasive and issued a Final Rejection, dated September 28, 2004, that maintained the rejection of claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 under 35 U.S.C. §102(b) as being anticipated by Tripathi, et al. and also maintained the rejection of claims 16, 17 and 22-24 under 35 U.S.C. § 103(a) as being unpatentable over Tripathi, et al. Claims 5, 10, 12-15, 18-20, 26, 27, 29-32, 38, 80 and 81 were still objected to as being dependent upon a rejected base claim.

A Notice of Appeal was filed on January 27, 2005.

Claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 are patentable under 35 U.S.C. §102(b) over Tripathi, et al. (U.S. Patent No. 5,974,089).

As an overview of the discussion below, Applicant respectfully submits that Tripathi, et al. '089 does not apply to radio frequency amplifiers and further does not show or suggest the claimed switching mode power amplifier ... to provide a radio frequency signal or a linearizer or a linearizer intercoupled as claimed or a linearizer using an adaptive process as claimed.

Tripathi et al ('089) concerns an approach for limiting the minimum time between transitions of pulses that are applied to an audio power amplifier 312 (see for example, abstract). More specifically, Fig. 2 shows a standard oversampled low pass second order (integrators 202, 206) sigma delta modulator with an output comparator stage 210 driving a power switch stage 212. Fig. 3 of Tripathi et al '089 shows the diagram of Fig. 2 with an additional pulse

qualification logic 318 and the corresponding description of 318 indicates as noted above that the function of logic 318 is to ensure a minimum time period between transitions (col.6, lines 12-14).

Tripathi et al '089 is an arrangement that is applicable to low frequency applications where narrow pulses are unacceptable, such as audio amplifiers ... (col.6, lines 50-54). In short Tripathi et al '089 is not applicable to radio frequency power amplifiers and in fact what is taught by Tripathi et al '089 would render a radio frequency amplifier impossible to construct, since as is known a radio frequency amplifier will necessarily have narrow pulses.

Referring to the Final Office Action of September 28, 2004, the Examiner agrees that Tripathi, et al. '089 does not apply to radio frequency amplifiers but further alleges that Applicant's arguments are focused only on the preamble, which the Examiner was unwilling to give patentable weight in this instance.

Applicant respectfully disagrees with the Examiner's interpretation noting that claim 1 in the context of defining A radio frequency amplifier system specifically recites among other affirmative features "a switching mode power amplifier ... operable to provide a radio frequency signal at an output; and a linearizer, coupled to ... the radio frequency signal ..." Applicant respectfully submits that specific affirmative recitations of a claim must be given patentable weight and clearly Tripathi, et al. '089 does not show or suggest the claimed switching mode power amplifier operable to provide a radio frequency signal or linearizer coupled thereto all as claimed. Thus and at least for this reason, independent claim 1 and each of claims 2-38 which are dependent thereon should be deemed allowable over Tripathi, et al. '089.

Regarding the Examiner's comments in the Office Action of March 3, 2004 and referring to claims 1-3, 6-9, 11, 21, 28, 33-37, 77-79, 82 and 83, the Examiner maintains that "Tripathi et al '089 (Fig. 2) discloses an amplifier circuit comprising a delta sigma modulator (206, 210) which is connected to receive an input signal (input) and produces a bi-level modulation signal (output of 210), a switching mode power amplifier (212) which is driven by the bi-level modulation signal (output of 210) and having an output (output), and a linearizer (204,202,208,214,216) which is coupled to the input signal (input) and the RF signal (output) to supply a corrective signal (output of 208) at a location prior to the switching mode power amplifier (212) wherein the linearizer (204,202,208,214,216) using an adaptive process."

Applicant respectfully disagrees with the Examiner's construction noting, for example, that the delta sigma modulator 206, 210 (using the Examiner's construction) is not connected to the input signal; rather 206, 210 are connected between the output of a summer 208 and input of a power switch 212 and none of the terminals of 206 or 210 are connected to the input signal. At best it might be argued that 206 is coupled to something somehow corresponding to the input signal, but certainly not connected to the input signal.

Furthermore 204, 202, 208, 214, 216 as depicted by Fig. 2 is not a linearizer as in so far as Applicant can determine these blocks do nothing to linearize a system (e.g. modify operation of a system, such as modify a signal or operational characteristics of a circuit to reduce overall distortion in the composite system). For example, these blocks do not compensate for distortion caused by switching stage 212 or any other stage by modifying an operating point for this stage or canceling or otherwise compensating for distortion or the like. These functional blocks are simply part of the delta sigma modulator of Tripathi et al '089.

Furthermore, this collection of functions is not adaptive in any sense of the word, as all of these stages have fixed functionality. The Examiner seems to be of the view that any collection of symbols in a figure can be appropriately referred to as a linearizer. Applicant strongly disagrees with this casual construction of Tripathi et al '089. For the Examiner's information and convenience, Applicant enclosed in the July 22, 2004 Response a paper by Grant et al entitled "A DSP Controlled Adaptive Feedforward Amplifier Linearizer" that was published in Vehicular Technology, Vol. 44 No. 1, pgs 31-40 February 1995 and discussed an Adaptive Amplifier linearizer. A second enclosure included in the July 22, 2004 Response was selected pages of a 1996 Thesis by Grant entitled "A DSP Controlled Adaptive Feedforward Amplifier Linearizer". The Thesis discusses some linearizer background beginning at page 4 showing that linearizers are known and were known at the time of Applicant's invention. Each of these papers includes a listing of additional references. However it was not known to combine such linearizers with the other structures of the claimed invention. Furthermore, the switching mode power amplifier (power switch 212) of Tripathi et al '089 does not show or suggest the claimed switching mode power amplifier ... operable to provide a radio frequency signal.

Applicant's claim 1 recites:

"A radio frequency amplifier system comprising:

a delta sigma modulator connected to receive an input signal and produce a bi-level modulation signal;

a switching mode power amplifier driven by the bi-level modulation signal and operable to provide a radio frequency signal at an output; and

a linearizer, coupled to the input signal and the radio frequency signal, operable to supply a corrective signal at a location prior to the switching mode power amplifier, the linearizer using an adaptive process.

Tripathi et al '089 does not show or suggest and in fact teaches away from a radio frequency amplifier. Applicant concedes that the reference shows or suggests a delta sigma modulator more or less as claimed by claim 1. However this reference does not show or suggest the claimed switching mode power amplifier providing a radio frequency signal and the reference does not show or suggest a linearizer or linearizer intercoupled as claimed or a linearizer that is adaptive as claimed. Therefore since Tripathi et al '089 does not show or suggest all limitations of the claimed invention as recited by claim 1 or claims dependent thereon, Applicant respectfully submits that Tripathi et al '089 does not support a rejection of claim 1 under §102(b). Claims 2-38 are dependent on claim 1 and at least by virtue of this dependency on a claim that is believed to be allowable should likewise be deemed allowable.

Claim 77 is another independent claim that defines:

"A radio frequency amplifier system comprising:

a bandpass delta sigma modulator connected to receive an input signal and produce a bi-level modulation signal;

a switching mode power amplifier driven by the bi-level modulation signal and having an output; and

a linearizer, coupled to the input signal and the output of the switching mode power amplifier, operable to supply a corrective signal at a location prior to the switching mode power amplifier, the linearizer using an adaptive linearization process."

Tripathi et al '089, for the reasons noted above, does not show or suggest a radio frequency amplifier. Furthermore, Tripathi et al '089 does not show or suggest a bandpass delta sigma modulator as claimed, although Applicant submits that other references included with the IDS may show such a structure. Additionally Tripathi et al '089 as noted above does not show or suggest a linearizer or linearizer intercoupled as claimed or linearizer using adaptive processes as

claimed. Thus and for one or more of these reasons, Applicant respectfully submits that Tripathi et al '089 does not support a rejection of claim 77 under §102(b). Claims 78-83 are dependent on claim 77 and at least by virtue of this dependency on a claim that is believed to be allowable should likewise be deemed allowable.

Therefore and at least for these reasons, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection of claims 1-4, 6-9, 11, 21, 25, 28, 33-37, 77-79, 82 and 83 under 35 U.S.C. 102(b) based on Tripathi, et al. (U.S. Patent No. 5,974,089).

<u>Additional reasons for allowing one or more of dependent claims 3-4, 8-9, 11, 16, 17, 21, 28, 33-37, 78-79, 82, and 83 will now be discussed.</u>

Other limitations of various of the dependent claims are not shown or suggested by Tripathi et al '089 taken alone or together with any other reference of record and thus various of the dependent claims are allowable for additional reasons that will be briefly and at least partially summarized below for the Examiner's convenience.

Regarding claim 3, Tripathi et al taken alone or together with other references of record does not show or suggest a multi-band bandpass delta sigma modulator. Claim 78 is similar to claim 3 but dependent on claim 77. Thus and for this additional reason, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed multi-band bandpass delta sigma modulator of claim 3 or 78 and does not support a rejection of claim 3 or 78 under §102(b).

Regarding claim 4, the Examiner maintains that "Tripathi et al. (Fig. 2) inherently includes a tunable output filter since it would not work without the filter." While it may be reasonable to argue that Tripathi needs an output filter, it is clearly erroneous to suggest that a tunable filter is needed. Applicant respectfully notes that Tripathi et al '089 addresses audio frequency applications or like low frequency applications and thus in Applicant's view almost certainly would not use a tunable filter. Applicant also notes that claim 4 recites a tunable output filter tunable to a plurality of frequency bands which clearly is not shown or suggested by this or any other combination of the references of record. Thus and for these additional reasons, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed tunable output filter of claim 4 and does not support a rejection of claim 4 under §102(b).

Claim 8-9, 11, 16-17, and 35 recite various limitations corresponding to an extended interface between the delta sigma modulator and the switching mode power

amplifier. Tripathi et al '089 does not show or suggest an extended interface as claimed by claim 8 and thus by virtue of dependency, claims 9, 11, 16-17, and 35. Therefore and for these additional reasons, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed extended interface of claims 8-9, 11, 16-17 and 35 and thus does not support a rejection of these claims under §102(b).

Claim 21 in addition to being dependent on claim 1, recites further limitations, specifically and respectively, generation of a corrective signal and various forms of linearization, regarding the linearizer recited in claim 1 and these limitations are not shown or suggested by Tripathi et al '089. Claims 82 and 83 are respectively analogous to claims 20 and 21 and further limit claim 77. Therefore and for these additional reasons, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed invention of claim 20-21 or by analogy claim 82-83 and thus does not support a rejection of these claims under §102(b).

Claim 28 further defines the switching mode power amplifier of claim 1 to have an adjustable output power. Claim 79 similarly limits claim 77. This is not shown or suggested by Tripathi et al '089. Therefore and for these additional reasons, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed invention of claim 28 or 79 and thus does not support a rejection of these claims under §102(b).

Claim 33-34 further defines the delta sigma modulator of claim 1 to be a multi-band bandpass delta sigma modulator suitable for simultaneous operation on a plurality of frequency bands. This is not shown or suggested by Tripathi et al '089 taken alone or together with any other reference(s) of record. Therefore and for these additional reasons, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed invention of claims 33-34 and thus does not support a rejection of these claims under §102(b).

Claim 36 – 37 as well as 38, recite specifics of supplying power to the power amplifier of claim 1. These limitations are not shown or suggested by Tripathi et al '089. Therefore and for these additional reasons, Applicant respectfully submits that Tripathi et al '089 does not show or suggest the claimed invention of claims 36-37 and thus does not support a rejection of these claims under §102(b).

Therefore and at least for the additional reasons noted above, Applicant respectfully submits that Tripathi et al '089 does show or suggest all limitations of claims 3-4, 8-9, 11, 20-21, 28, 33-37, 78-79, 82 and 83. Thus Applicant for these additional reasons respectfully requests the Examiner to reconsider and withdraw this rejection of claims 3-4, 8-9, 11, 20-21, 28, 33-37, 78-79, 82 and 83 under 35 U.S.C. 102(b) based on Tripathi, et al. (U.S. Patent No. 5,974,089).

Claims 16, 17 and 22-24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Tripathi, et al.

Claims 16, 17 and 22-24 are each dependent on claim 1 and at least by reason of dependency on a claim that is believed to be allowable over the references of record should likewise be allowable. Therefore, Applicant respectfully requests that the Examiner reconsider and withdraw the rejection of claims 16, 17 and 22-24 under 35 U.S.C. 103(a) based on Tripathi, et al.

Claims 5, 10, 12-15, 18-20, 26, 27, 29-32, 38, 80 and 81 are objected to as being dependent upon a rejected base claim.

These claims have been objected to as dependent upon a rejected base claim but would be allowable if rewritten to include all limitations of the base and any intervening claims. Applicant appreciates and concurs with the Examiner's view that these claims define allowable subject matter and thus are believed to be separately patentable. Furthermore these claims are dependent on one or more claims that are believed to be allowable over the references of record and thus Applicant respectfully submits that this objection should be withdrawn. Applicant may wish to amend such claims if further discussions of the independent/intervening claims are not productive.

Summary

In summary, applicant respectfully submits that Tripathi, et al. '089 does not show or suggest all features of the claimed invention as recited by independent claims 1 or 77, dependent claims 3-4, 8-9, 11, 16, 17, 21, 28, 33-37, 78-79, 82, 83, or by virtue of dependency 2, 6-7, 16, 17

or 22-25 and thus does not support a 35 U.S.C. 102(b) or 103(a) rejection of such claims. Based on the comments above and in view of the evidence presented, Applicant respectfully submits that independent claims 1 and 77 as well as dependent claims 2-38 and 78-83 are patentable over Tripathi, et al. '089 under 35 U.S.C. 102(b) or 103(a). Accordingly, it is believed that the rejection of these claims in reliance on this reference is traversed and that these claims are presently in condition for allowance.

IX. APPENDIX I

The text of the claims on appeal is:

1. (Previously Presented) A radio frequency amplifier system comprising:

a delta sigma modulator connected to receive an input signal and produce a bi-level modulation signal;

a switching mode power amplifier driven by the bi-level modulation signal and operable to provide a radio frequency signal at an output; and

a linearizer, coupled to the input signal and the radio frequency signal, operable to supply a corrective signal at a location prior to the switching mode power amplifier, the linearizer using an adaptive process.

2. (Original) The radio frequency amplifier system of claim 1 wherein the delta sigma modulator comprises a bandpass delta sigma modulator.

3. (Original) The radio frequency amplifier system of claim 2 wherein the bandpass delta sigma modulator comprises a multi-band bandpass delta sigma modulator.

4. (Previously presented) The radio frequency amplifier system of claim 1 comprising a tunable output filter coupled to the output of the amplifier, the tunable output filter tunable to a plurality of frequency bands.

5. (Previously Presented) The radio frequency power amplifier system of claim 1 wherein the delta sigma modulator comprises:

a digital-to-analog converter coupled to receive a signal from an output of a first resonator circuit and present the digitized signal at an output of the delta sigma modulator,

a second resonator circuit having an input coupled to receive an input signal and an output coupled to an input of the first resonator circuit, and

an analog-to-digital converter coupled to receive the digitized signal, generate a re-created analog signal from the digitized signal, and combine the recreated analog signal with signals at the inputs of each of the first and second resonator circuits.

6. (Previously presented) The radio frequency amplifier system of claim 1 wherein the switching mode power amplifier comprises a class S amplifier.

7. (Previously presented) The radio frequency amplifier system of claim 1 wherein the switching mode power amplifier comprises a class D amplifier.

8. (Previously presented) The radio frequency amplifier system of claim 1 comprising an extended interface between the delta sigma modulator and the switching mode power amplifier, the extended interface carrying the bi-level modulation signal.

9. (Previously presented) The radio frequency amplifier system of claim 8 wherein the extended interface comprises a first coupling circuit coupling the bi-level modulation signal to a transmission medium and a second coupling circuit coupling the bi-level modulation signal to the switching mode power amplifier.

10. (Previously presented) The radio frequency amplifier system of claim 9 wherein the transmission medium comprises an optical transmission medium, the first coupling circuit comprises an electro-optical coupler and the second coupling circuit comprises an opto-electrical coupler.

11. (Previously presented) The radio frequency amplifier system of claim 10 wherein the optical transmission medium comprises an optical fiber.

12. (Previously presented) The radio frequency amplifier system of claim 9 wherein the transmission medium comprises a microwave radio link, the first coupling circuit comprises a high speed digital modulator and the second coupling circuit comprises a high speed digital demodulator.

13. (Previously presented) The radio frequency amplifier system of claim 9 wherein the transmission medium comprises a path through signal carriers of a cable television system, the first coupling circuit comprises a high speed digital modulator and the second coupling circuit comprises a high speed digital demodulator.

14. (Previously presented) The radio frequency amplifier system of claim 9 wherein the transmission medium comprises a coaxial cable.

15. (Previously presented) The radio frequency amplifier system of claim 9 wherein the extended interface is bidirectional.

16. (Previously presented) The radio frequency power amplifier system of claim 9 wherein the first and second coupling circuits are separated by a distance of at least 10 meters.

17. (Previously presented) The radio frequency amplifier system of claim 9 wherein the first and second coupling circuits are separated by a distance of at least 500 meters.

18. (Previously presented) The radio frequency amplifier system of claim 9 wherein the linearizer generates the corrective signal at least in part from a feedback signal from an output of the switching mode power amplifier and the feedback signal is carried on the extended interface.

19. (Previously presented) The radio frequency amplifier system of claim 18 comprises a power monitor coupled to the output of the switching mode power amplifier wherein the feedback signal comprises a signal carrying information regarding a power level detected by the power monitor.

20. (Previously presented) The radio frequency amplifier system of claim 1 wherein the linearizer is configured to generate a predistortion signal based upon a feedback signal from an output of the switching mode power amplifier and the corrective signal is based upon the predistortion signal.

21. (Previously presented) The radio frequency power amplifier system of claim 1 wherein the linearizer is configured to generate the corrective signal through one or more of: feed forward; analog predistortion; digital predistortion; adaptive digital predistortion; predistortion and feed forward; and adaptive feedforward.

22. (Previously presented) The radio frequency power amplifier system of claim 1 having a passband at a frequency in excess of 300 kHz.

23. (Previously presented) The radio frequency power amplifier system of claim 1 having a passband at a frequency in excess of 800 MHz.

24. (Previously presented) The radio frequency power amplifier system of claim 1 wherein the output of the switching mode power amplifier is coupled to an antenna, the switching mode power amplifier is located within 2 meters from the antenna and the delta sigma modulator is located more than 5 meters from the antenna.

25. (Previously presented) The radio frequency power amplifier system of claim 1 comprising a harmonic filter connected at the output of the switching mode power amplifier.

26. (Previously presented) The radio frequency power amplifier system of claim 6 wherein the class S amplifier comprises two electronic switching device in a totem pole configuration.

27. (Previously presented) The radio frequency power amplifier system of claim 6 wherein the output of the class S amplifier comprises first and second terminals and the class S amplifier comprises first and second switching devices connected in series with one another, the first switching device coupled between the first terminal and a first conductor, the second switching device coupled between the first terminal and a second conductor maintained at a second voltage relative to the first conductor by a power supply, and second and third switching devices connected in series with one another, the second switching device coupled between the first conductor and the second terminal, the fourth switching device coupled between the second terminal and the second conductor.

28. (Previously presented) The radio frequency power amplifier system of claim 1 wherein the switching mode power amplifier has an adjustable output power.

29. (Previously presented) The radio frequency power amplifier system of claim 28 wherein the switching mode power amplifier comprises an electronically variable voltage bias power supply and a mechanism connected to vary the voltage of the bias power supply and thereby vary the output power of the switching mode power amplifier.

30. (Previously presented) The radio frequency power amplifier system of claim 28 wherein the switching mode power amplifier comprises a plurality of parallel-connected amplification circuits and a mechanism connected to adjust the output power by varying a number of the amplification circuits which are active by selectively enabling or disabling some of the amplification circuits.

31. (Previously presented) The radio frequency power amplifier system of claim 30 wherein each of the amplification circuits comprises an electronically variable voltage bias power supply and a mechanism connected to vary the voltage of the bias power supply and the amplification circuits are enabled and disabled by varying the voltage of the corresponding bias power supply.

32. (Previously presented) The radio frequency power amplifier system of claim 21 comprising a mechanism for adjusting the output power of the switching mode power amplifier in response to a channel count, a channel link loss parameter, or both a channel count and a channel link loss parameter.

33. (Previously presented) The radio frequency power amplifier system of claim 1 wherein the delta sigma modulator comprises a multiband bandpass delta sigma modulator capable operating in two or more frequency bands simultaneously.

34. (Previously presented) The radio frequency power amplifier system of claim 33 comprising a multiband programmable variable tuning output filter connected to filter a signal amplified by the switching mode power amplifier.

35. (Previously presented) The radio frequency power amplifier system of claim 8 wherein the switching mode power amplifier is coupled to an antenna, the antenna and switching mode power amplifier are both on a tower and the delta sigma modulator is not located on the tower.

36. (Previously presented) The radio frequency power amplifier system of claim 1 comprising a power supply connected to supply electrical power to the switching mode power amplifier wherein the power supply comprises a solar panel.

37. (Previously presented) The radio frequency power amplifier system of claim 1 comprising a power supply connected to supply electrical power to the switching mode power amplifier wherein the power supply comprises a wind generator.

38. (Previously presented) The radio frequency power amplifier system of claim 37 wherein the power supply comprises an electrical storage cell charged by the wind generator and a dc-dc step-up converter connected to receive power from the storage cell at a voltage of the storage cell

and provide the power to the switching mode power amplifier at an increased voltage greater than the voltage of the storage cell.

39. (Withdrawn) A radio frequency transmission system comprising:

a modulator producing a bi-level modulation signal,

an extended interface connected to carry the bi-level modulation signal, and

an amplifier, the amplifier connected to receive and amplify the bi-level modulation signal.

40. (Withdrawn) The radio frequency transmission system of claim 39 wherein the extended interface comprises a first coupler circuit coupling the bi-level modulation signal to a transmission medium and a second coupling circuit coupling the bi-level modulation signal to the amplifier.

41. (Withdrawn) The radio frequency transmission system of claim 40 wherein the transmission medium comprises an optical transmission medium, the fist coupling circuit comprises an electro-optical coupler and the second coupling circuit comprises an opto-electrical coupler.

42. (Withdrawn) The radio frequency transmission system of claim 41 wherein the optical transmission medium comprises an optical fiber.

43. (Withdrawn) The radio frequency transmission system of claim 40 wherein the transmission medium comprises a microwave radio link, the first coupling circuit comprises a high speed digital modulator and the second coupling circuit comprises a high speed digital demodulator.

44. (Withdrawn) The radio frequency transmission system of claim 40 wherein the transmission medium comprises a path through signal carriers of a cable television system, the first coupling circuit comprises a high speed digital modulator and the second coupling circuit comprises a high speed digital demodulator.

45. (Withdrawn) The radio frequency transmission system of claim 40 wherein the transmission medium comprises a coaxial cable.

46. (Withdrawn) The radio frequency transmission system of claim 40 wherein the extended interface is bidirectional.

47. (Withdrawn) The radio frequency transmission system of claim 46 comprising a single transmission medium carrying bidirectional signals.

48. (Withdrawn) The radio frequency transmission system of claim 46 comprising a plurality of transmission media each carrying unidirectional signals.

49. (Withdrawn) The radio frequency transmission system of claim 46 comprising a linearizer configured to generate a corrective signal at least in part from a feedback signal from an output of the amplifier wherein the feedback signal is carried to the linearizer on the extended interface.

50. (Withdrawn) The radio frequency transmission system of claim 49 comprising a power monitor coupled to the output of the amplifier wherein the feedback signal comprises a signal carrying information regarding a power level detected by the power monitor.

51. (Withdrawn) The radio frequency transmission system of claim 50 wherein the linearizer is configured to generate a predistortion signal based upon the feedback signal and the corrective signal is based upon the predistortion signal.

52. (Withdrawn) The radio frequency transmission system of claim 40 wherein the first and second coupling circuits are separated by a distance of at least 10 meters.

53. (Withdrawn) The radio frequency transmission system of claim 40 wherein the first and second coupling circuits are separated by a distance of at least 500 meters.

54. (Withdrawn) The radio frequency transmission system of claim 39 wherein the modulation signal comprises a pulse density modulated signal.

55. (Withdrawn) The radio frequency transmission system of claim 54 wherein the modulator comprises a delta sigma modulator.

56. (Withdrawn) The radio frequency transmission system of claim 39 comprising a linearizer, the linearizer generating a corrective signal in response at least in part to a feedback signal carried to the linearizer on the extended interface.

57. (Withdrawn) The radio frequency transmission system of claim 39 wherein the amplifier comprises a switching mode power amplifier.

58. (Withdrawn) The radio frequency transmission system of claim 57 wherein the amplifier comprises a class S amplifier.

59. (Withdrawn) The radio frequency transmission system of claim 57 wherein the amplifier is configured to provide a plurality of selectable power output levels.

60. (Withdrawn) The radio frequency transmission system of claim 59 comprising a power requirement determination mechanism connected to control the amplifier by selecting one of the power output levels in response to a power requirement determined by the power requirement determination mechanism.

61. (Withdrawn) The radio frequency transmission system of claim 39 wherein the modulator and amplifier are supplied by separate power supplies.

62. (Withdrawn) The radio frequency transmission system of claim 61 wherein the amplifier is supplied by a power supply comprising a solar panel.

63. (Withdrawn) The radio frequency transmission system of claim 62 wherein the power supply comprises an electrical storage cell charged by the solar cell and a dc-dc step-up converter

connected to receive power from the storage cell at a voltage of the storage cell and provide the power to the amplifier at an increased voltage greater than the voltage of the storage cell.

64. (Withdrawn) The radio frequency transmission system of claim 61 wherein the amplifier is supplied by a power supply comprising a wind generator.

65. (Withdrawn) The radio frequency transmission system of claim 64 wherein the power supply comprises an electrical storage cell charged by the wind generator and a dc-dc step-up converter connected to receive power from the storage cell at a voltage of the storage cell and provide the power to the amplifier at an increased voltage greater than the voltage of the storage cell.

66-67. Cancelled

68. (Withdrawn) The radio frequency transmission system of claim 39 comprising a plurality of modulators and a plurality of corresponding amplifiers wherein the extended interface carries a modulation signal from each of the modulators to each of the amplifiers.

69. (Withdrawn) The radio frequency transmission system of claim 68 wherein the plurality of amplifiers are each associated with a sector of a multi-sectored antenna.

70. (Withdrawn) The radio frequency transmission system of claim 68 wherein the plurality of amplifiers are each associated with an element in a phased antenna array.

71-75. Cancelled

76. (Withdrawn) A microwave transmission method comprising

converting an analog microwave signal into a binary two-level signal capable of driving a switching mode amplifier; and,

driving a switching mode amplifier with the binary two-level signal.

77. (Previously Presented) A radio frequency amplifier system comprising:

a bandpass delta sigma modulator connected to receive an input signal and produce a bi-level modulation signal;

a switching mode power amplifier driven by the bi-level modulation signal and having an output; and

a linearizer, coupled to the input signal and the output of the switching mode power amplifier, operable to supply a corrective signal at a location prior to the switching mode power amplifier, the linearizer using an adaptive linearization process.

78. (Previously presented) The radio frequency amplifier system of claim 77 wherein the bandpass delta sigma modulator comprises a multi-band bandpass delta sigma modulator.

79. (Previously presented) The radio frequency power amplifier system of claim 77 wherein the switching mode power amplifier has an adjustable output power.

80. (Previously presented) The radio frequency power amplifier system of claim 79 wherein the switching mode power amplifier comprises an electronically variable voltage bias power supply and a mechanism connected to vary the voltage of the bias power supply and thereby vary the output power of the switching mode power amplifier.

81. (Previously presented) The radio frequency power amplifier system of claim 79 wherein the switching mode power amplifier comprises a plurality of parallel-connected amplification circuits and a mechanism connected to adjust the output power by varying a number of the amplification circuits which are active by selectively enabling or disabling some of the amplification circuits.

82. (Previously presented) The radio frequency amplifier system of claim 77 wherein the linearizer is configured to generate a predistortion signal based upon a feedback signal and the corrective signal is based upon the predistortion signal.

83. (Previously presented) The radio frequency power amplifier system of claim 77 wherein the linearizer is configured to generate the corrective signal through one or more of: feed forward; analog predistortion; digital predistortion; adaptive digital predistortion; predistortion and feed forward; and adaptive feedforward processes.

Respectfully submitted,

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